

relatively to the ether, there is a Doppler resistance to the drift utterly negligible on the sun and planets, but quite appreciable on meteoric dust. I confess that I am utterly unable to tackle the equations of motion when this force is taken into account, but if we make rough approximations it seems possible that it too would lead to a gradual approach to the sun. The most obvious method of approximation in dealing with a small disturbing force is to omit it. Let us adopt this method here, and turn to another effect which can be tackled—a Doppler reception effect, which only comes into play when a particle is changing its distance from the sun.

Imagine a particle moving in an elliptic orbit to be coming towards the sun. The sun pressure against it is slightly increased by the motion, or, virtually, gravitation is lessened. When the particle has swung round the sun and is retreating, the sun pressure is slightly lessened, or, virtually, gravitation is increased. That is, there is always a force tending to resist change of distance from the sun, tending, I take it, to make the orbit less eccentric, more circular.

Now let us see how these forces will act on a comet, supposing a comet to consist of a somewhat thinly scattered cloud of particles of various sizes down to, say, a ten-thousandth of an inch in diameter. Somewhat below that size the particles would be repelled and never tend to approach the sun at all, and would be weeded out of the comet as it first came into our system. Let us suppose that, to begin with, the various sizes are well mixed up. Then at once a sorting action will begin. The direct sun pressure will lengthen out the year of the finer particles more than that of the coarser, and they will gradually trail behind in the orbit.

Then the Doppler emission effect will gradually damp down the motion, again more markedly with the finer particles, and they will tend to spiral in towards the sun and shorten the period of revolution. Then the Doppler reception effect will tend to make the orbit ever less elliptic, and again with the smaller particles the action will be more rapid.

In any single revolution the effect will no doubt be small, even on the smaller particles, but after thousands or millions of revolutions the particles of different sizes may move in orbits so different that they may not appear to have any connection with each other. In course of ages all the smaller particles, and if we have a sufficient balance in the bank of astronomical time even the larger particles, will end their course in the sun itself.

There is one member of our system, Encke's comet, which at first sight looks as if it were manifesting these actions even in the short time, less than a century, that it has been under observation. Its motion is commonly interpreted as a shortening of its period by  $2\frac{1}{2}$  hours in each revolution of  $3\frac{1}{2}$  years. But Mr. H. C. Plummer has investigated its case, and finds such difficulties, difficulties with which I need not now trouble you, that I fear the obvious explanation that the Doppler resistance is the cause must be abandoned. But though we may not notice the effects in any short time, I see no escape from the conclusion that if comets are clouds of small particles brought into, and made members of, our system, they at once begin to undergo a sorting action, the finer particles drawing inwards more rapidly, and ultimately ending their career in the sun. Possibly the Zodiacal Light is the dust of long dead comets.

Where our ignorance is complete and unbounded hardly any supposition can be ruled out. Let me, then, in conclusion, make one wild suggestion. Suppose that a larger planet, still so hot as to be a small sun, succeeds in capturing a cloud of cometary dust. Just the action I have been describing should go on. The cloud would gradually spread into a long trail, the larger particles leading, the smaller dropping behind and moving in, and ultimately we might have a ring round the planet, a ring tending to become more and more circular as time went on, with the larger particles outside and the finer particles forming an inner fringe. With different grades of dust we might have different rings. Is it possible that Saturn has been wild enough to have adopted this suggestion?

## UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The special board for mathematics is now submitting for the approval of the Senate regulations for part i. and part ii. of the mathematical tripos embodying the resolutions which were adopted by Senate on October 25. It has been found necessary to make provision for the transition from the present system to the new one, and some temporary provisions are suggested for this purpose. In other respects all the regulations now submitted have already been published in the draft regulations appended to the report above referred to. It is these detailed regulations that the master of Sidney Sussex College and some other members of the Senate have announced their intention to "non-placet."

The observatory syndicate has been considering the great increase in astrophysical work which has been in the last few years carried on in the University observatory by Mr. H. F. Newall. It considers the time has come when an assistant of university standing should be appointed to assist Mr. Newall, and announces the generous offer of Mr. Newall to find 100*l.* a year for five years toward the stipend of such an assistant. The syndicate recommends (1) that for a period of five years, from January 1, 1907, there be appointed at the observatory an assistant, to be entitled "the assistant in astrophysics," who shall be under the general direction of the Newall observer; (2) that the assistant in astrophysics be appointed by Mr. Newall with the consent of the Vice-Chancellor, and be removable in like manner; (3) that a stipend of 100*l.* per annum, payable from the University chest, be assigned to the assistant in astrophysics, Mr. Newall having undertaken to augment the stipend by an annual sum of 100*l.* for a period of five years from January 1, 1907.

Two largely signed memorials have been presented to the council of the Senate. The first urges (1) that a paper or papers in natural science shall be included amongst the compulsory subjects of any examination which may be substituted for the present previous examination, and (2) that in the classical part of such an examination no separate paper in Greek and Latin grammar shall be set. The second requests the council of the Senate to appoint a syndicate to consider the advisability of instituting a diploma in architecture in view of the great importance of architectural studies, which has already been felt in other universities, where such studies have been successfully organised.

The following have been nominated examiners in the mechanical sciences tripos:—Prof. Hopkinson, Prof. W. E. Dalby, and Mr. C. E. Ingles; in State medicine, Dr. Anningson, Prof. Nuttall, Dr. J. Lane Notter, Dr. R. D. Sweeting, and Dr. A. Newsholme; in the diploma of tropical medicine and hygiene, Prof. Nuttall, Mr. C. W. Daniels and Mr. W. B. Leishman.

The board of agricultural studies, in consultation with the president of the Royal Agricultural Society, has appointed Major P. G. Craigie, C.B., to be Gilbey lecturer on the history of the economics of agriculture for three years from January 1.

A syndicate has been nominated to obtain plans and estimates for the extension of the Cavendish Laboratory on the site recently assigned it by a Grace of the Senate. This extension has been rendered possible by the generosity of Lord Rayleigh, who has presented the Nobel prize to the University.

Mr. Aubrey Strahan, St. John's College, has been approved by the general board of studies for the degree of Doctor in Science.

A University lectureship in botany is now vacant by the resignation of Prof. Seward. The general board of studies will shortly proceed to appoint a lecturer to hold office from Christmas, 1906, until Michaelmas, 1911. The annual stipend is 100*l.* Candidates are requested to send their applications, with testimonials if they think fit, to the Vice-Chancellor on or before November 30, 1906.

Mr. R. P. Gregory, of St. John's College, has been appointed senior demonstrator in botany until September 30, 1911.

Mr. A. Hutchinson, of Pembroke College, has been

appointed chairman of the examiners for the natural sciences tripos, 1907.

DR. H. E. ANNETT has been elected to the newly-established chair of comparative pathology in the University of Liverpool.

THE second award of the Vulcan fellowship in engineering of the Victoria University of Manchester will be made this session. Applications should be made to the registrar on or before December 10. The fellowship, which is of the annual value of 120*l.*, offers exceptional opportunities for research in engineering. It is tenable for one year, but may be renewed for a second, and in special circumstances for a third, year.

THE *Times* states that the trustees of the late Mr. T. Graham Young have presented to the governors of the Glasgow and West of Scotland Technical College a sum of 10,000*l.* to assist in making provision for the teaching of dyeing and bleaching in connection with the chair of technical chemistry in the college. Mr. Young's trustees have also voted a sum of 850*l.* for the equipment of the laboratory for the chair.

THE regulations for admission to the schools of mines at Clausthal and Berlin, and to the mining and metallurgical department of the Aachen Technical School, have been brought into unison. Hitherto, at Clausthal and Berlin, on matriculation twelve months' practical experience was demanded, whilst at Aachen no previous practical training was required. Moreover, at Aachen the length of the course was three years, whilst at Clausthal and Berlin it was four years. Henceforth no practical experience will be demanded for entry at Clausthal and Berlin, but on entering for the first examination students will be required to furnish evidence of six months' practical work. At Aachen the course will in future cover four years.

THE London County Council has decided to expend 37,500*l.* in acquiring sites for secondary-school and training-college purposes in the districts of Clapham, Wandsworth, North London, and Tooting. The schools are needed for the scholars elected under the council's new scholarship scheme. It is proposed to erect six schools on the sites, three for boys and three for girls, and to adapt as a training college a mansion at present standing on one of the sites. The cost of erecting the six schools will be about 160,000*l.*, and that of adapting the mansion 8000*l.* It is anticipated that four more schools will be needed to provide for the full number contemplated by the scholarship scheme. The total expenditure upon the council's proposals with regard to secondary schools is estimated at 575,000*l.*

A MOVEMENT has been started for the reconstitution of Queen's College, Cork, and its conversion into a university centre for Munster. Speaking at a meeting convened on Saturday last by the Lord Mayor of Cork and Mr. McDonald, chairman of the County Council, Mr. William O'Brien, M.P., said it is proposed to do in Cork what has been done in Birmingham. The institution to be set up will be purely democratic. It will belong to the people, and will be governed by the people's representatives. The governing purpose of the university will be to open up a career in life to every gifted child in the province. Mr. O'Brien and his wife have decided to bequeath on their demise practically all their property as a contribution towards the endowment of a Cork University. Mr. O'Brien said it should be possible to arrange, if the borough and county councils of the province are willing to assume a temporary burden, which will be an exceedingly slight one, and every shilling of which will be repaid at his and his wife's death, that a sum of 50,000*l.* can be at once made available.

THE recently published annual report on the work of the Glasgow and West of Scotland Technical College supplies as an appendix a report on a visit to American educational institutions, presented to the governors by Mr. H. F. Stockdale, the secretary and director of the college. The subject of the director's inquiry was especially the equipment of the engineering schools visited, with a view to the economical and judicious expenditure of the grants

made to the engineering departments of the Glasgow college. Mr. Stockdale insists that the only points where the superiority of American schools must be admitted are those in which the weight of money turns the scale. The laboratory equipments are generally far more extensive and include more costly apparatus than is within the means of most British colleges. The environment of certain American institutions, such as that of the University of Wisconsin and of Cornell University, is, too, a great advantage. The director was much impressed by the facilities in the States for the study of railway mechanical engineering, and he points out that this seems to be a field in which the Glasgow college might do good work. An Englishman in charge of a section of the metallurgical department of Columbia University alleged that many British students proceed to the States to study metallurgy. Like other British visitors to America, the Scottish director saw and heard with envy the large number of able men on the staff in nearly all the best colleges in the States, and noted that the heads of departments are allowed plenty of time for research. The circumstance that the large staffs make it possible for professors to engage in outside professional practice, to the advantage of the work of their colleges, is also commented upon. Mr. Stockdale has written a very useful report, which will repay attention from educational authorities.

## SOCIETIES AND ACADEMIES.

LONDON.

**Chemical Society, November 1.**—Prof R. Meldola, F.R.S., president, in the chair.—A development of the atomic theory, which correlates chemical and crystalline structure and leads to a demonstration of the nature of valency: W. Barlow and W. J. Pope. The authors represent atoms in the combined state by "spheres of influence." An examination of the geometrical properties of closely-packed assemblages of spheres shows that the atoms of the elements must be represented by spheres of influence directly proportional in volume to their fundamental valencies, and that a closely-packed assemblage built up of spheres of the appropriate sizes, so as to represent some particular compound, can be partitioned into units identical with the chemical molecule, and possesses symmetry and dimensions compatible with those of the crystalline substance. In addition, it is shown that close-packed homogeneous assemblages of spheres possess other properties which lead to simple interpretations of multivalency and tautomerism, and that ethylenic and acetylenic bonds and isomerism have complete analogues in peculiarities of homogeneous assemblages of spheres.—Synthesis of carvestrene. Preliminary notice: W. H. Perkin, jun., and G. Tattersall.—Some derivatives of catechol, pyrogallol, benzophenone, and of some substances allied to the natural colouring matters: W. H. Perkin, jun., and C. Weizmann. This communication contains descriptions of the preparation and properties of a number of new substances obtained at different times in connection with researches on the constitution of brazilin, hæmatoxylin, and other natural colouring matters.—Experiments on the synthesis of the terpenes, part ix., the preparation of cyclopentanone-4-carboxylic acid and of cyclohexanone-4-carboxylic acid (8-ketohexahydrobenzoic acid): F. W. Kay and W. H. Perkin, jun.—The hydrolysis of "nitrocellulose" and "nitroglycerine": O. Silberrad and R. C. Farmer. The hydrolysis is complicated by the simultaneous reduction of the nitric acid, and intermediate products are formed, which are gradually acted upon by the alkali; these are practically insoluble in water and do not give rise to free acid when left in contact with water for several days.—The acidic constants of some ureides and uric acid derivatives: J. K. Wood. In compounds which contain the grouping  $\cdot\text{CO}\cdot\text{NH}\cdot\text{CO}\cdot\text{NH}\cdot\text{CO}\cdot$ , there appears to be a mutual reinforcement of the imino-groups by the carbonyl groups present analogous to that exhibited by the carboxyl groups in succinic acid.—The affinity constants of xanthine and its methyl derivatives: J. K. Wood. The results of determinations of the basic and acidic constants of xanthine, 7-methylxanthine, the three isomeric dimethylxanthines, and caffeine are described.—The explosive com-